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EXPERIMENTAL ANALYSIS ON TREATED AND UNTREATED GRASS/CARBON HYBRID COMPOSITE STRUCTURES

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ABSTRACT

Hybrid composites are having the greatest potential for engineers in many applications. A hybrid polymer composite offers the designer to obtain the necessary properties to a substantial extent by the choice of fibers and matrix. In the present investigation, the mechanical properties of carbon and grass fibers reinforced polyester hybrid composite were studied. The hand lay up technique was used for the fabrication of hybrid composites. The mechanical properties such as tensile strength, flexural strength and impact strength of the hybrid composites were evaluated as per the ASTM standards. The variation of mechanical properties such as tensile, flexural and impact properties of randomly oriented polyester based grass/carbon fiber reinforced hybrid composites with different fiber weight ratios have been studied. Comparison of treated and untreated fibers was also studied. The mechanical properties were improved as the carbon fiber content increased in the matrix material.

KEYWORDS: Carbon Fibre, Grass Fibre, Polyester, Tensile Strength & Impact Strength

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Original Article

INTRODUCTION

As of late, fiber strengthened composites are being used for an assortment of structures, running from an airplane, space crafts and to structures and extensions. This wide utilization of composites have been encouraged by the presentation of novel materials, advancement in assembling procedures and improvements to new testing strategies also. Fiber-fortified materials are better than those of most amalgams since it has high mechanical properties and their quality to-weight proportions. Use of composite materials as auxiliary materials is enhancing step by step, since it makes the planner outline for the attributes of composites is an imperative preferred standpoint Ihueze et al [1]. Noorunnisa et al [2] researched the Tensile, Flexural and Chemical Resistance Properties of sisal/carbon crossover composites and found that the carbon wt% in the mixture composites enhances the mechanical properties and furthermore the treatment of normal strands enhances the properties. UdayaKiran et al [3] contemplated the Tensile Properties of Sisal Fiber Reinforced Polyester Composites and found that the fiber weight proportion and fiber lengths result in better rigidities. Smole et al [4] examined the physical properties of Grass filaments and announced the effect of its treatment with various arrangements. SuharaPanthpulakkal et al. [5] examined the mechanical and thermal properties of infusion formed short hemp/glass fiber strengthened hybrid composites alongside water assimilation tests and inferred that the expansion of glass fiber content enhances the performance properties, thermal properties and furthermore the water ingestion properties of the hemp fiber. Varadarajulu et al. [6] contemplated the tractable properties of edge guard/glass fiber fortified phenolic composites

and detailed that the pliable properties are enhanced with expanding glass fiber content in the half and half composites. Singha et al. [7] contemplated the synthetic protection, mechanical and physical properties of biofiber based polymer composites. Gangjian et al [8] researched on the portrayal of carbon/wood fiber fortified half breed composites by fluctuating polypropylene and carbon rate. Doba et al [9] tractable and affect the properties of a half and half polyethylene/epoxy mix framework with carbon fiber texture In the present work, the examination is completed to know the mechanical properties of carbon fiber cross breed composites, for example, malleable, flexural and affect quality. Study of these properties is imperative in contrast with physical properties.

MATERIALS AND METHODS

Materials

Grass filaments utilized as a part of the present investigation were gathered from neighborhood sources. Woven material carbon fiber was likewise utilized as a part of the present examination and is appeared in Figure 1. Elite polyester tar and the Methyl ethyl ketone peroxide were utilized as an impetus and cobalt naphthenate was utilized as a quickening agent. Grass fiber was absorbed 5% NaOH answer for 1hour to expel the oily substance and hemicelluloses and later on it was washed altogether in refined water and dried for 48hrs.

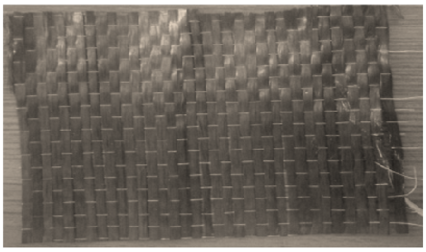

Figure 1: Carbon Fiber

Preparation of Hybrid Composite

The diverse blends (100/0, 75/25, 50/50, 25/75, 0/100) were chosen to influence hybrid to grass/carbon/polyester covers. Hand lay-up method was utilized to set up the test examples. Afterward, the framework has filled a shape made of glass plates of size 160mm x 160mm x 3mm (Length x Width x Thickness) has appeared in Figure.2. The shape was covered with a thin layer of wax, which goes about as a decent discharging specialist. Abundance saps and air bubbles were expelled painstakingly with the assistance of a roller, and a glass plate was put on top alongside weights of around 25kgs. The castings were taken into consideration 24 h at room temperature and post cured at 80oC for 15min. Subsequent to curing the plate was expelled from the trim box. With basic decreasing and it was cut into tests for affect test according to ASTM details.

Figure 2: Glass Mold used for the Fabrication

Tensile, Flexural and Impact Tests Measurement

The Rigidity was resolved to utilizing INSTRON UTM. The cross-set out speed toward tractable test was kept up at 10mm/min. The temperature and dampness of the test were kept up at 250 and 25% individually. In every one of the cases, five examples were tried and normal esteems are accounted for. The flexural quality was likewise dictated by utilizing three focuses bowing on the examples with measurements 150mm × 20mm × 3 mm are cut according to ASTM D 790-07 determinations. The cross-set out speed toward flexural test was additionally kept up at 10mm/min. For each situation, five examples were tried and normal esteems are accounted for alongside mistake bars. The Ductile and Flexural test setup has appeared in Figure.3.

Figure 3: Flexural Test Setup on INSTRON

The effect quality is resolved to utilize IZOD affect analyzer. The test examples with measurements 120mm × 13mm × 3 mm are cut according to ASTM D 256-88 details. For each situation, five examples are tried and normal esteem is recorded. The Effect test setup has appeared in Figure.4.

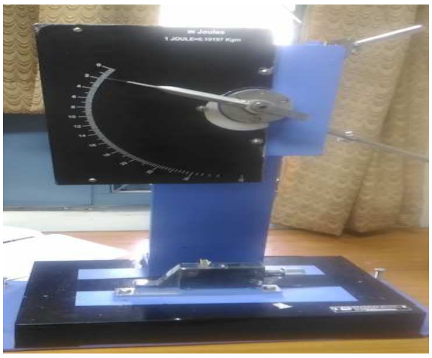

Figure 4: IMPACT Test Setup

RESULTS AND DISCUSSIONS

Tensile Tests

Tensile strength is a standout amongst the most huge and is most generally determined property. A tensile strength of lattice and arbitrarily arranged untreated grass/carbon fiber strengthened cross breed composites and 5% NaOH treated grass/carbon fiber half breed composites with various proportions of fiber weight i.e. 100-0, 75-25, 50-50, 25-75 and 0-100 were appeared in Table 1. From the table, it was watched that rigidity increments with carbon fiber content. It was additionally seen from the table that treated hybrid composites have more quality when contrasted with untreated mixture composites. Change of elastic properties for treated composites is because of the evacuation of hemicellulose and lignin. This expands the interface holding between the fiber and the matrix. Figure 5 demonstrates the variety of rigidity for

treated and untreated grass/carbon fiber strengthened hybrid composites with various fiber weight proportions. It was watched that carbon fiber composites have higher elasticity than hybrid composites.

Table 1: Tensile Strength of Treated and Untreated Grass/Carbon Hybrid Composites for different weight Ratios

S. No	Fibre Ratios	Tensile Strength MPa	
		Untreated	Treated
1	0-100	21.21	38.14
2	25-75	28.54	52.64
3	50-50	35.68	69.81
4	75-25	48.15	92.49
5	100-0	95.97	96.01

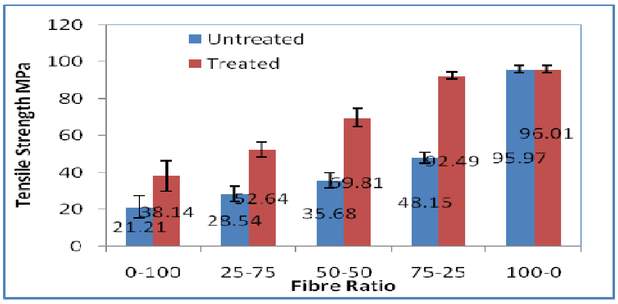

Figure 5: Variation of Tensile Strength for Treated and Untreated fibers with Different Fiber Ratios

Flexural Tests

Flexural quality of matrix and haphazardly arranged untreated grass/carbon fiber strengthened crossover composites and 5% NaOH treated grass/carbon fiber hybrid composites with various proportions of fiber weight i.e. 100-0, 75-25, 50-50, 25-75 and 0-100 were appeared in Table 2. From the table, it was watched that flexural quality increments with carbon fiber content. It was likewise seen from the table that treated cross breed composites have more quality when contrasted with untreated hybrid composites. Change of flexural properties for treated composites is because of the evacuation of hemicellulose and lignin. This expands the interface holding the fiber and the framework. Figure 6 demonstrates the variety of flexural quality of treated and untreated grass/carbon fiber strengthened cross breed composites with various fiber weight proportions. It was watched that carbon fiber composites have higher flexural quality than mixture composites.

Table 2: Flexural Strength of Treated and Untreated Grass/Carbon Hybrid Composites for Different Weight Ratios

S. No	Fibre Ratios	Flexural Strength MPa	
		Untreated	Treated
1	0-100	50.84	68.54
2	25-75	71.19	92.18
3	50-50	102.58	109.49
4	75-25	111.48	119.58
5	100-0	127.01	126.91

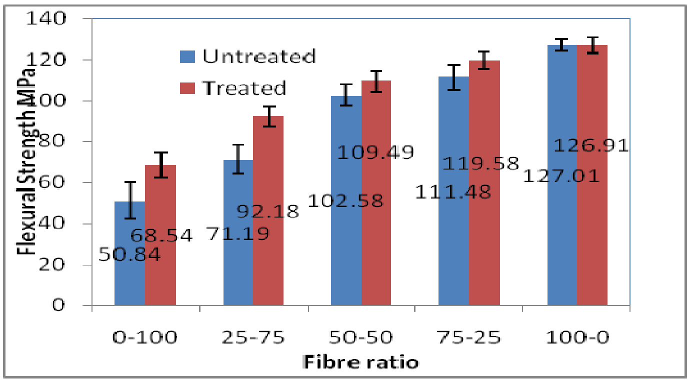

Figure 6: Variation of Flexural Strength of Treated and Untreated Fibres with Different Fibre Ratios

Impact Tests

Effect quality of impact and haphazardly situated untreated grass/carbon fiber strengthened hybrid composites and 5% NaOH treated grass/carbon fiber half breed composites with various proportions of fiber weight i.e. 100-0, 75-25, 50-50, 25-75 and 0-100 were appeared in Table 3. From the table, it was watched that flexural quality increments with carbon fiber content. It was additionally seen from the table that treated cross breed composites have more effect quality when contrasted with untreated half breed composites. Change of effect properties for treated composites is because of the evacuation of hemicellulose and lignin. This builds the interface holding the fiber and the network. Figure 7 demonstrates the variety of effect quality for treated and untreated grass/carbon fiber strengthened mixture composites with various fiber weight proportions. It was watched that carbon fiber composites have higher effect quality than hybrid composites.

Table 3: Impact Strength of Treated and Untreated Grass/Carbon Hybrid Composites for Different Weight Ratios

S. No	Fibre Ratios	Impact Strength J/m	
		Untreated	Treated
1	0-100	150.11	194.81
2	25-75	171.58	204.54
3	50-50	202.12	258.67
4	75-25	231.45	272.95
5	100-0	289.71	289.79

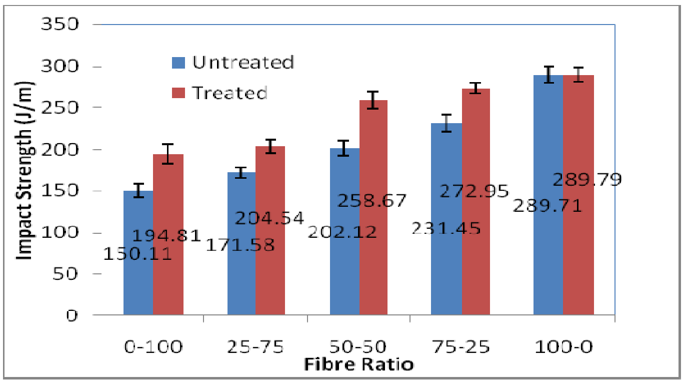

Figure 7: Variation of Impact Strength for Treated and Untreated Fibres with Different Fibre Ratios

CONCLUSIONS

The mechanical properties, for example, Ductile, Flexural, and Effect properties of both treated and untreated strands were contemplated for grass/carbon cross breed composites with various fiber weight proportions. It is plainly demonstrated that there has been an upgrade in these mechanical properties with expanded carbon fiber content in the hybrid composites. The impact of salt treatment for grass filaments on the Malleable, Flexural and Effect properties have additionally been considered and announced. It is discovered that treated mixture composites have more Pliable, Flexural and Effect quality than untreated hybrid composites

REFERENCES

1. *Ihueze CC, Okafor CE, Okoye CI. Natural fiber composite design and characterization for limit stress prediction in multi-axial stress state. Journal of King Saud University –EngineeringSciences. 2015; 27(2):193-206.*
2. *P. NoorunnisaKhanam, H. P. S. Abdul Khalil, M. Jawaid, G. Ramachandra Reddy, C. Surya Narayana, S. Venkata Naidu Sisal/Carbon Fibre Reinforced Hybrid Composites: Tensile, Flexural and Chemical Resistance Properties. J Polym Environ (2010) 18:727–733.*
3. *UdayaKiran, G. Ramachandra Reddy, B. M. Dabade, S. Rajesham, Tensile Properties of Sun Hemp, Banana and Sisal Fiber Reinforced Polyester Composites, Journal Of Reinforced Plastics And Composites, Vol. 26, No. 10/2007.*
4. *M. SfiligojSmole, K. S. Kleinschek, T. Kre, S. Strnad, M. Mandl, and B. Wachter, Physical Properties of Grass Fibres, ChemBiochemEng Q, 18 (1) 47–53 (2004).*
5. *Hayder A. Mehdi & Maryam Sinan , Effect of Slenderness Ratio on the Behavior of Reinforced Concrete Column Confined with Carbon Fiber Reinforced Polymer Composites Under Axial Load, International Journal of Civil, Structural, Environmental and Infrastructure Engineering Research and Development (IJCSEIERD) Volume 7, Issue 6, November - December 2017, pp. 1-20*
6. *Panthapulakkal S, Sain M (2007) Injection-molded short hemp fibre/glass fibre-reinforced polypropylene hybrid composites-mechanical, water absorption and thermal properties. J ApplPolymSci 103:2432–2441.*
7. *VaradaRajulu A, Rama Devi R (2007) Tensile properties of ridge gourd/phenolic composites and glass/ridge gourd/phenolic hybrid composites. J ReinfPlast Compos 26:629–638.*
8. *Singha AS, Thakur VK (2009) Chemical resistance, mechanical and physical properties of biofibers-based polymer composites. PolymPlastTechnol Eng. 48:736–744.*
9. *GangjianGuo, Joseph C. Chen, Guan Gong, and MuralidharReddy Lingam, Injection Molding and Mechanical Characterizion of Carbon Fiber-Woodfiber/Polyproplene Hybrid Composites, SPE ANTEC Indianapolis 2016 / 1106.*
10. *Y. Dobah, Y. Ghazzawi, M. Bourchak, Mechanical Properties of Hybrid Carbon Fiber Reinforced Polyethylene and Epoxy Composites, ARPN Journal of Engineering and Applied Sciences, Vol. 10, No. 16, September 2015.*